Remarks

Claim 1 has been amended to remove the term "nano-clays". Support for the above-requested amendments to claim 21 is found at least at paragraphs [0009] and [0011] of the specification. Claims 9 and 16 have been canceled without prejudice. Claims 10 and 11 have been amended to change the dependency of the claim. Claims 12 and 13 were amended for grammatical reasons. Claims 17-20, 22, and 24 were canceled in previous Amendments. At least claims 10-13 have been amended for reasons not related to patentability. Newly added claim 25 is supported at least by paragraphs [0008]-[0010], [0021], and [0023]. Support for newly added claim 26 is found at least in paragraph [0021]. No question of new matter arises and entry of the amendments and new claims is respectfully requested.

Claims 1-8, 10-15, 21, 23, and 25-26 are before the Office for consideration.

Formal Matter

As shown above, Applicants have added new claims 25-26 by amendment (*i.e.*, two claims). Additionally, claims 9 and 16 (*i.e.*, two claims) have been canceled without prejudice. Because the total number of claims Applicants are submitting for examination (*i.e.*, twenty claims) is not greater than the total number of claims previously presented and paid for (*i.e.*, twenty claims), Applicants respectfully submit that no additional filing fees are required for newly added claims 25-26.

In addition, Applicants respectfully submit that there are no fees required for new independent claim 25 because the total number of independent claims present in the application (*i.e.*, three independent claims) does not exceed the total amount of independent claims permitted by the U.S. Patent and Trademark Office without incurring additional fees (*i.e.*, three independent claims). Furthermore, because support for newly added claims 25-26 is found throughout the specification, as identified in the opening paragraph of the Remarks, Applicants respectfully submit that these newly added claims do not contain any new matter.

Rejection of Claims 1-16 under 35 U.S.C. §103(a)

Claims 1-16 have been rejected under 35 U.S.C. §103(a) as being unpatentable over WO 2001/39954 to Grinshpun *et al.* ("Grinshpun") in view of U.S. Patent No. 6,795,446 to Lee *et al.* ("Lee"). The Office asserts that Grinshpun teaches a method of manufacturing a rigid foam that includes (1) incorporating fillers and at least one nucleating agent and

reinforcing materials such as graphite, conductive carbon black and nanofillers into a polymer, (2) incorporating a blowing agent into the melt under a first temperature and a first pressure, (3) extruding the polymer melt under a second temperature and second pressure to allow the polymer melt to expand and foam, and (4) cooling the foamed product. It is asserted that the foam has a cell size that ranges from 25 - 7000 microns. Grinshpun does not explicitly teach that the nano-particle fillers are nano-clays or intercalated or expanded graphite. Nor does Grinshpun teach the particle size of the fillers and reinforcing materials. However, the Office asserts that Lee teaches methods similar to Grinshpun that disclose the use of nano-clays that have a thickness of less than 1 nm. The Office concludes that it would have been obvious to one of skill in the art to take the method of Grinshpun and modify it with the nano-clay additives taught by Lee to improve the physical properties of the foam.

In response to this rejection, Applicants respectfully direct the Office's attention to independent claim 1 and submit that claim 1 defines a method of manufacturing a rigid foam that is not taught or suggested within Grinshpun, either alone or in combination with Lee. Grinshpun teaches a method for preparing a foam structure that includes hollow, coalesced foam strands. (*See, e.g.*, Abstract and page 1, lines 6 - 9). Optionally, the foam structure may include solid, coalesced strands. (*See, e.g.*, page 1, lines 9 - 12). The first step of the process includes providing a foamable composition that includes a blowing agent composition and at least one film forming composition. (*See, e.g.*, page 2, lines 16 - 18 and page 20, lines 9 - 11). The foamable composition is preferably a foamable polymer such as an olefinic homopolymer. (*See, e.g.*, page 20, lines 11 - 13). Optionally, the foamable composition may include at least one additive or modifier selected from fire retardant chemicals, stabilizers, antioxidents, colorants, permeability modifiers, plasticizers, static dissipative agents, anti-static agents, surfactants, and opacifiers. (*See, e.g.*, page 20, lines 16 - 22). The blowing agent composition must effect a foaming of the film forming composition. (*See, e.g.*, page 3, lines 20 - 21). The foamable composition is in a gel state. (*See, e.g.*, page 2, line 18 and page 20, line 15). Next, the foamable composition is extruded through a die that has a plurality of orifices, each of which forms a hollow extrudate. (*See, e.g.*, page 2, lines 19 - 21 and page 20, lines 22 - 24). The hollow extrudate is converted into foamed hollow extrudate strands at a temperature that promotes bubble stability. (*See, e.g.*, page 2, lines 22 - 24 and page 20, lines 26 - 28). The final step includes permitting the hollow strands to contact and adhere to

each other to form a hollow, multistrand polymer foam extrudate. (*See, e.g.*, page 2, lines 25 - 28 and page 20, lines 28 - 31).

Lee teaches the use of nano-sized particles to form a microcellular foam that has a high density and a small cell size (*e.g.*, less than 5 microns). (*See, e.g.*, Abstract). The disclosed method for forming a polymeric foam with such a small cell size includes (1) providing a mixture of a polymer, an organophilic clay, and a blowing agent and (2) processing the mixture to cause the formation of cells. (*See, e.g.*, column 2, lines 30 - 35).

Applicants respectfully submit that neither Grinshpun nor Lee teach or suggest the incorporation of nano-particles selected from calcium carbonate, intercalated graphites and expanded graphites that have a particle size in at least one dimension less than 100 angstroms in a polymer melt. Lee specifically teaches the incorporation of an organophilic clay that has a thickness less than 1 nm (*see, e.g.*, column 2, lines 30-35 and 42-50 and column 6, lines 44-46), but does not teach or suggest the incorporation of any other nano-particles in the nanocomposite foam. In fact, Lee is silent with respect to any teaching or suggestion of the use of nano-particles selected from calcium carbonate, intercalated graphites, or expanded graphite. Accordingly, Applicants respectfully submit that the combination of Grinshpun and Lee would not result in the presently claimed invention.

In addition, Applicants submit that there is no motivation for one of skill in the art to arrive at the presently claimed invention based on the disclosures of Grinshpun and Lee. To establish a *prima facie* case of obviousness, there must be some motivation, either within the reference or in the knowledge of those of skill in the art, to modify the reference or combine the references' teachings, there must be a reasonable expectation of success, and the prior art references must meet all of the claim limitations. (*See, e.g., Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 3, August 2005, §2142). It is respectfully submitted that one of ordinary skill in the art would not be motivated to arrive the presently claimed process that includes the incorporation of a nano-particle nucleating agent selected from calcium carbonate, intercalated graphites, and expanded graphites that have a particle size in at least one dimension less than 100 angstroms based on the teachings of Grinshpun and Lee because both Grinshpun and Lee are silent as to any teaching or suggestion of calcium carbonate, intercalated graphites and expanded graphites that have a particle size in at least one dimension less than 100 angstroms as required by claim 1. Therefore, Applicants respectfully submit that one of ordinary skill in the art would have no

motivation to utilize a nano-particle nucleating agent selected from calcium carbonate, intercalated graphites, and expanded graphites that have a particle size in at least one dimension less than 100 angstroms in the claimed method based on the teachings of Grinshpun and/or Lee. Without some teaching or suggestion, there can be no motivation, and without motivation, there can be no *prima facie* case of obviousness.

With respect to claims 2-16, Applicants submit that because independent claim 1 is not taught or suggested by Grinshpun and Lee and claims 2-16 are dependent upon independent claim 1 and contain the same elements as claim 1, dependent claims 2-16 are also not taught by Grinshpun and Lee.

In light of the above, Applicants submit that claims 1-16 are not obvious over Grinshpun in view of Lee and respectfully request that this rejection be reconsidered and withdrawn.

Rejection under 35 U.S.C. §103(a)

The Office has rejected claims 1-16 as being unpatentable over WO 2001/40362 to Miller, *et al.* ("Miller") in view of U.S. Patent No. 6,518,324 to Kresta, *et al.* ("Kresta"). In particular, the Office asserts that Miller teaches the claimed process of producing an extruded foam product where a blowing agent is incorporated into the polymer melt at a first pressure and temperature, extruding the polymer melt under a second pressure and temperature to form a foam, and intrinsically cooling the foam to form a product with a cell size within the claimed range. It is asserted that the preferred polymer melt includes an alkenyl aromatic polymer material. The Office admits that Miller does not disclose incorporating nano-particles. In this regard, Kresta is cited for teaching the utilization of nano-clays that have a thickness of about 3-1000 angstroms in polymer foams (*e.g.*, polystyrene foams). The Office concludes that it would have been obvious to one of ordinary skill in the art to employ the nano-clays of Kresta in the method of Miller for the purpose of producing a foam with improved thermal insulation.

In response to this rejection, Applicants respectfully direct the Office's attention to the amendments made to independent claim 1 and submit that claim 1 defines a method of manufacturing a rigid foam that is not taught or suggested within Miller, either alone or in combination with Kresta. Miller teaches a process for making an extruded polymer foam that includes heating a polymer to form a melt polymer material, incorporating titanium dioxide

and talc into the melt polymer, incorporating a blowing agent at an elevated pressure to form a foamable gel, cooling the foamable gel to an optimum foaming temperature, and extruding the cooled foamable gel through a die into a zone of reduced pressure. (*See, e.g.*, page 2, lines 7-12 and page 2, line 25 to page 3, line 3). It is asserted that the titanium dioxide and talc, when used together, reduce the oblong cell size shape in the z-axis to create rounder shaped cells. (*See, e.g.*, page 2, lines 19-22 and page 4, line 30 to page 5, line 1). Although any polymer may be used, a preferred thermoplastic polymer is an alkenyl aromatic polymer material. (*See, e.g.*, column 3, lines 25-27 and column 4, lines 1-2). It is asserted that the resultant extruded foamed products generally have a relatively low density, generally less than about 60 kg/m^3, and an average cell size from about 0.01 to about 0.4 mm. (*See, e.g.*, page 9, lines 15-26). In addition, the foamed products contain a major amount of closed cells and a minor amount of open cells. (*See, e.g.*, page 10, lines 5-6).

Kresta teaches polymer foams that contain nano-clays that have a thickness from about 3-1000 angstroms and a size in the planar direction ranging from about 0.01 to 100 microns. (*See, e.g.*, column 1, lines 5-6, and 44-52). The amount of nano-clay added to the polymer foam composition generally ranges from about 0.01 to about 10 parts of 100 parts by weight of the polymer resin. (*See, e.g.*, column 2, lines 10-12). It is asserted that the inclusion of nano-clays improve the thermal insulation properties of the foam. (*See, e.g.*, column 1, lines 34-40 and the Abstract).

Applicants respectfully submit that neither Miller nor Kresta teach or suggest the incorporation of nano-particles selected from calcium carbonate, intercalated graphites and expanded graphites that have a particle size in at least one dimension less than 100 angstroms in a polymer melt as required by claim 1. As discussed above, Kresta only teaches the use of nano-clays (*e.g.* montmorillonite) with a thickness from about 3-1000 angstroms in the foam composition. (*See, e.g.*, column 1, lines 44-52). In fact, Kresta is silent as to any teaching or suggestion of any other types of nano-particles, including the claimed calcium carbonate, intercalated graphites, and expanded graphites. Accordingly, Applicants respectfully submit that the combination of Miller and Kresta would not result in the presently claimed invention.

In addition, Applicants submit that there is no motivation for one of skill in the art to arrive at the presently claimed invention based on the disclosures of Miller and Kresta. To establish a *prima facie* case of obviousness, there must be some motivation, either within the reference or in the knowledge of those of skill in the art, to modify the reference or combine

the references' teachings, there must be a reasonable expectation of success, and the prior art references must meet all of the claim limitations. (*See, e.g., Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 3, August 2005, §2142). It is respectfully submitted that one of ordinary skill in the art would not be motivated to arrive the presently claimed process that includes the incorporation of nano-particles selected from calcium carbonate, intercalated graphites, and expanded graphites that have a particle size in at least one dimension less than 100 angstroms based on the teachings of Miller and Kresta because both Miller and Kresta are silent as to any teaching or suggestion of calcium carbonate, intercalated graphites, and expanded graphites that have a particle size in at least one dimension less than 100 angstroms as required by claim 1. As a result, one of ordinary skill in the art would not be motivated to utilize a nano-particle nucleating agent selected from calcium carbonate, intercalated graphites, and expanded graphites that have a particle size in at least one dimension less than 100 angstroms in the claimed method based on the teachings of Miller and/or Kresta. As discussed above, without some teaching or suggestion, there can be no motivation, and without motivation, there can be no *prima facie* case of obviousness.

With respect to claims 2-16, Applicants submit that because independent claim 1 is not taught or suggested by Miller and Kresta and claims 2-16 are dependent upon independent claim 1 and contain the same elements as claim 1, dependent claims 2-16 are also not taught by Miller and/or Kresta.

In light of the above, Applicants submit that claims 1-16 are not obvious over Miller in view of Kresta and respectfully request reconsideration and withdrawal of this rejection.

Rejections of Claims 21 and 23 under 35 U.S.C. §103(a)

(1) The Office has rejected claims 21 and 23 under 35 U.S.C. §103(a) as being unpatentable over WO 2001/40362 to Miller, *et al.* ("Miller") in view of U.S. Patent No. 6,699,454 to Moy, *et al.* ("Moy") or U.S. Patent No. 6,815,491 to Adedeji, *et al.* ("Adedeji").

In particular, the Office asserts that Miller teaches the claimed process of producing an extruded foam product where a blowing agent is incorporated into the polymer melt at a first pressure and temperature, extruding the polymer melt under a second pressure and temperature to form a foam, and intrinsically cooling the foam to form a product with a cell

size within the claimed range. It is asserted that the preferred polymer melt includes an alkenyl aromatic polymer material. The Office admits that Miller does not teach acicular nano-particles as claimed.

In this regard, Moy and Adedeji are cited for individually teaching the employment of reinforcing fillers suitable for foam applications in the form of elongated fibers. The Office concludes that it would have been obvious to one of skill in the art to employ the reinforcing fillers of Moy or Adedeji in the method of Miller for the purpose of reinforcing the foam and improving the insulation properties of the foam.

(2) The Office has rejected claims 21 and 23 under 35 U.S.C. §103(a) as being unpatentable over WO 2001/39954 to Grinshpun *et al.* ("Grinshpun") in view of U.S. Patent No. 6,699,454 to Moy, *et al.* ("Moy") or U.S. Patent No. 6,815,491 to Adedeji, *et al.* ("Adedeji").

In particular, the Office asserts that Grinshpun teaches a method of manufacturing a rigid foam that includes (1) incorporating fillers and at least one nucleating agent and reinforcing materials such as graphite, conductive carbon black, and nanofillers into a polymer, (2) incorporating a blowing agent into the melt under a first temperature and a first pressure, (3) extruding the polymer melt under a second temperature and second pressure to allow the polymer melt to expand and foam, and (4) cooling the foamed product. It is asserted that the foam has a cell size ranging from 25 - 7000 microns. The Office admits that Grinshpun does not specify the shape (*e.g.*, acicular) or particle size of the fillers and reinforcing materials.

In this regard, Moy and Adedeji are cited for individually teaching the employment of reinforcing fillers suitable for foam applications in the form of elongated fibers. The Office concludes that it would have been obvious to one of skill in the art to employ the reinforcing fillers of Moy or Adedeji in the method of Grinshpun for the purpose of reinforcing the foam and for the purported purpose of improving the insulation properties of the foam.

(3) Applicants' Response

In response to these rejections, Applicants respectfully direct the Office's attention to the amendments to claim 21 and submit that claim 21 defines a method of manufacturing a rigid foam that is not taught or suggested by Miller, Grinshpun, Moy, and/or Adedeji. Because the process for producing an extruded foam product disclosed by Miller and the

foamed product of Grinshpun were described in detail above, for purposes of brevity, they will not be discussed in detail with respect to these rejections.

Moy teaches a method for the manufacture of a catalyst for the production of improved carbon fibrils and carbon fibril aggregates. (*See, e.g.*, column 4, lines 19-20 and 27-30 and the Abstract). The improved carbon fibrils have a substantially constant diameter from about 1.0 to about 100 nm. (*See, e.g.*, the Abstract).

Adedeji teaches a reinforced thermoplastic composition that includes a poly(arlyene ether), a poly(alkenyl aromatic) compound, a polyolefin, a hydrogenated block copolymer with a high alkenyl aromatic content, a polyolefin-graft-cyclic anhydride copolymer, and a reinforcing filler. (*See, e.g.*, column 2, lines 35-45 and the Abstract). Glass, talc and organoclays are preferred reinforcing fillers. (*See, e.g.*, column 9, line 60 and column 10, lines 15-17 and 50-53). Preferred talcs have an average particle size from about 0.5 to about 25 micrometers. (*See, e.g.*, column 10, lines 18-19). The length of the glass fibers may be from 0.1 to 20 mm.

Applicants respectfully submit that none of Miller, Grinshpun, Moy, or Adedeji teach or suggest a method of manufacturing a rigid foam that includes (1) incorporating acicular nano-particles selected from nano-clays, calcium carbonate, intercalated graphites, and expanded graphites into a polymer melt, where the nano-particles have a particle size in at least one dimension less than 100 angstroms, (2) adding a blowing agent into the polymer melt under a first pressure and at a first temperature, (3) extruding the polymer melt under a second pressure and at a second temperature sufficient to allow the polymer melt to expand and form a foam, and (4) cooling the foam to form a foam product. There is simply no teaching or suggestion within Miller, Grinshpun, Moy, or Adedeji of incorporating acicular nano-particles selected from nano-clays, calcium carbonate, intercalated graphites, and expanded graphites into a polymer melt as required by claim 21. In fact, each of Miller, Grinshpun, Moy, and Adedeji are silent as to any teaching or suggestion of acicular nano-clays, calcium carbonate, intercalated graphites, or expanded graphites, or of incorporating such into a polymer melt. It is respectfully submitted that the combination of the teachings of Miller, Grinshpun, Moy, and Adedeji, in any combination, would not result in the inventive method of claim 21. Accordingly, Applicants respectfully submit that claim 21 is non-obvious and patentable over Miller, Grinshpun, Moy, and/or Adedeji.

In addition, Applicants submit that there is no motivation for one of skill in the art to arrive at the presently claimed method based on the disclosures of Miller, Grinshpun, Moy, and Adedeji. In order to establish a *prima facie* case of obviousness, there must be some motivation, either within the reference or in the knowledge of those of skill in the art, to modify the reference or combine the references' teachings, there must be a reasonable expectation of success, and the prior art references must meet all of the claim limitations. (*See, e.g., Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 3, August 2005, §2142). It is respectfully submitted that one of skill in the art would not be motivated to arrive at the method claimed in claim 21 that includes (1) incorporating acicular nano-particles selected from nano-clays, calcium carbonate, intercalated graphites and expanded graphites into a polymer melt, where the nano-particles have a particle size in at least one dimension less than 100 angstroms, (2) adding a blowing agent into the polymer melt under a first pressure and at a first temperature, (3) extruding the polymer melt under a second pressure and at a second temperature sufficient to allow the polymer melt to expand and form a foam, and (4) cooling the foam to form a foam product based on the teachings of Miller, Grinshpun, Moy, and Adedeji because each of Miller, Grinshpun, Moy, and Adedeji are silent as to any teaching or suggestion of acicular nano-particles selected from nano-clays, calcium carbonate, intercalated graphites, and expanded graphites. As a result, one of ordinary skill in the art would not be motivated to utilize the claimed acicular nano-particles in a polymer melt based on the teachings of Miller, Grinshpun, Moy, and/or Adedeji. Without some teaching or suggestion, there can be no motivation, and without motivation, there can be no *prima facie* case of obviousness.

In view of the above, it is respectfully submitted that independent claim 21 is not taught or suggested by Miller, Grinshpun, Moy, and/or Adedeji and that claim 21 is therefore non-obvious and patentable. Because claim 23 is dependent upon claim 21, which is not taught or suggested by Miller, Grinshpun, Moy, and/or Adedeji, in any combination as discussed above, and because claim 23 is dependent upon independent claim 21 and contains the same elements as claim 21, dependent claim 23 is also not taught or suggested by Miller, Grinshpun, Moy, and/or Adedeji.

In light of the above, Applicants submit that claims 21 and 23 are non-obvious and patentable over (1) Miller in view of Moy or Adedeji and (2) Grinshpun in view of Moy or Adedeji and respectfully request reconsideration and withdrawal of these rejections.

Conclusion

In light of the above, Applicants believe that this application is now in condition for allowance and therefore request favorable consideration.

If any points remain in issue which the Office feels may be best resolved through a personal or telephone interview, the Office is kindly requested to contact the undersigned at the telephone number listed below.

If necessary, the Commissioner is hereby authorized to charge payment or credit any overpayment to Deposit Account No. 50-0568 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

Date: 10/3/07

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